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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/535,070	05/12/2005	Johannes Engelbertus Adrianus Maria Van Den Meerakker	NL02 1185 US	5660

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EXAMINER

DAHIMENE, MAHMOUD

ART UNIT PAPER NUMBER

1765

DATE MAILED: 09/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/535,070

Applicant(s)

VAN DEN MEERAKKER ET AL.

Examiner

Mahmoud Dahimene

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 05 July 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-13 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Van Den Meerakker et al. (Journal of The Electrochemical Society, 147 (7) pages 2757-2761 (2000)) in view of Grüning et al. (US 5,987,208), and further in view of Bielgelsen et al. (US 5,607,876).

The reference of Van Den Meerakker describes a method for etching of deep macropores which will also result in the formation of nanowires if the etching is carried out such as the diameter of the pores, arranged in a hexagonal array (page 2757,

Art Unit: 1765

paragraph "Experimental"), is large enough to allow intersection of the pores leaving narrow regions between pores which will become the "nanowires" formed on the semiconductor material (silicon wafer). The method comprises;

providing a patterned etching mask (silicon nitride) having openings on a surface of a substrate made of the semiconductor material, which openings have a substantially uniform pitch (hexagonal array), placing the substrate with the etching mask in a liquid etchant for the semiconductor material (figure 1); anodically etching so as to form substantially parallel pores with a pitch corresponding to the pitch of the openings in the etching mask (figure 2).

A difference is noted between applicants claim 1 and the reference of Van Den Meerakker cited above, Van Den Meerakker is silent about the diameter of the pores becomes at least as great as the pitch of the pores, whereby nanowires are formed, however, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Van Den Meerakker by widening the diameter of the pores until nanowires are formed because the hexagonal pattern of the pores is conducive to formation of pores and islands (wires) when the pore diameters intersect. One of ordinary skill in the art would have been motivated to form nanowires because nanowires are useful for electro-optical and electromechanical devices.

A second difference is noted between applicants claim 1 and the reference of Van Den Meerakker cited above, Van Den Meerakker is silent about the anodic etching is carried out in a first time period and a second time period, which periods correspond to a first and a second region along the nanowires, such that etching takes place in the

Art Unit: 1765

second period at a higher current density than in the first period so that the nanowires formed have a greater diameter in the first region than in the second region.

The reference of Grüning discloses a method for etching cylindrical cavities with variable diameter along the axis (figure 2), electrochemical etching is used (column 3, line 45) and the etch diameter is controlled by the applied current density on the substrate which reads on the applicant's limitation of the anodic etching is carried out in a first time period and a second time period, which periods correspond to a first and a second region along the pores (nanowires).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Van Den Meerakker by alternatively varying the current density to the substrate during etching to form a thinner diameter at the base of the nanowires for easy break-off at the end of the process because the reference of Grüning teaches how to etch a feature with variable diameter. One of ordinary skill would have been motivated to narrow the nanowires diameter in order to have an easy break-off point when applying mechanical stress such as ultrasonic vibration when separation of the nanowires from the substrate is desired.

A third difference is noted between applicants claim 1 and the reference of Van Den Meerakker cited above, Van Den Meerakker is silent about oxidizing a surface of the nanowires, whereupon said surface is removed by etching.

The reference of Bielgelsen teaches oxidation/etch steps are conventionally used for thinning quantum wires (column 7, line 65).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Van Den Meerakker by adding oxidation steps for thinning the nanowires because Bielgelsen teaches oxidation/etch steps are conventionally used for thinning quantum wires. One of ordinary skill in the art would have been motivated to use oxidation in order to obtain thinner nanowires which is more desirable for higher integration requirements.

***Claim Rejections - 35 USC § 103***

4. Claims 2-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Van Den Meerakker et al. (Journal of The Electrochemical Society, 147 (7) pages 2757-2761 (2000)) in view of Grüning et al. (US 5,987,208), and Bielgelsen et al. (US 5,607,876) as applied to claim 1 above, and further in view of Kishi et al. (US 2003/0098640).

A difference is noted between applicants claim 2 and the reference of Van Den Meerakker cited above, Van Den Meerakker is silent about the removal taking place in a bath wherein a dispersion of nanowires is formed.

Kishi describes a method of separating nanotubes from a substrate citing the carbon nanotube can be extracted by applying ultrasonic wave to the carbon nanotubes dipped in a solvent such as ethanol so that they are peeled off the substrate (page 6, paragraph 0106) which reads on the applicant's limitation of forming a dispersion (page 6, paragraph 0112).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Van Den Meerakker to include a

Art Unit: 1765

step for removing the nanowires in an ultrasonic bath wherein a dispersion is formed because the reference of Kishi teaches nanostructures such as tubes are conventionally removed from substrate using ultrasonic bath wherein a dispersion is formed. One of ordinary skill in the art would have been motivated to use an ultrasonic bath wherein a dispersion is formed in order to efficiently separate the nanowires from the substrate.

As to claim 3, It is noted that reference of Van Den Meerakker cited above is silent about the step of oxidation and removal is repeated.

However, if the nanowires length is shorter than the substrate thickness it would be obvious to one of ordinary skill in the art at the time the invention was made to further modify the method of Van Den Meerakker to use the same substrate to form more nanowires after the removing step because the structure needed for formation of new wires is left on the substrate after the previous removing step. One of ordinary skill in the art would have been motivated to use the same substrate to form more nanowires in order to save the cost of forming a new substrate.

As to claim 4, the limitation of "the anodic etching is carried out during a plurality of alternating first and second time periods so as to form a plurality of first and second regions which alternate along the lengths of the nanowires" has been addressed in the rejection of claim 1.

As to claim 5, the dispersion addressed in the rejection of claim 2 above will provide a layer of material and that material could be desired. Applicant has not shown any unexpected results related to the desirability of the material in claim 5.

***Claim Rejections - 35 USC § 103***

5. Claims 6-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Van Den Meerakker et al. (Journal of The Electrochemical Society, 147 (7) pages 2757-2761 (2000)) in view of Grüning et al. (US 5,987,208), and Bieltgelsen et al. (US 5,607,876) and Kishi et al. (US 2003/0098640) as applied to claims 1-5 above, and further in view of Dennis et al. (US 2004/0076681).

A difference is noted between applicants claim 6 and the reference of Van Den Meerakker cited above, Van Den Meerakker is silent about a sol-gel process.

The reference of Dennis discloses "Silica nanotubes were prepared by the sol-gel method...This process yields silica nanotubes lining the pore walls plus silica surface films on both faces of the membrane" (page 10, paragraph 0121).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Van Den Meerakker to include an additional step of providing a layer material by means of a sol-gel process because the reference of Dennis teaches sol-gel processes are conventionally used for lining nanostructures. One of ordinary skill in the art would have been motivated to use a sol-gel process to line the nanowires in order insure uniform coating around the wires, the sol-gel of Dennis provides silicon oxide (silica) but could also include a coloring agent. One of ordinary skill in the art would have found it obvious to include the coloring agent in the sol-gel if uniform coloration is preferred, rather than using a separate process for applying the coloring agent separately.



As to claims 10, 11 It is noted that the reference of Van Den Meerakker is silent about wires length in a range of 0.3 to 1  $\mu\text{m}$ .

The reference of Grüning discloses a an etch depth of 10  $\mu\text{m}$  in 10 minutes (column 5, line 47).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Van Den Meerakker to use the etch method of Grüning and adjust the time such that the wires length is in a range of 0.3 to 1  $\mu\text{m}$  with an appropriate error margin. One of ordinary skill in the art would be motivated to adjust the etch time in order to obtain the desired etch depth within an appropriate error margin.

As to claim 12, 13 the modified method of Van Den Meerakker as described above would provide a method of manufacturing a device provided with nanowires on a substrate, in which method a dispersion of nanowires is provided on the substrate, characterized in that the dispersion as claimed in claim 7 is provided on the substrate. The dispersion can be used to manufacture any electronic device comprising a layer in which nanowires are dispersed, which nanowires have a predefined length distribution.

### ***Response to Arguments***

6. Applicant's arguments filed on 07/05/2006 have been fully considered but they are not persuasive.

In response to applicant's argument that Meerakker is silent about nanowires, the office action states "Den Meerakker describes a method for etching of deep macropores

Art Unit: 1765

which will also result in the formation of nanowires if the etching is carried out such as the diameter of the pores, arranged in a hexagonal array (page 2757, paragraph "Experimental"), is large enough to allow intersection of the pores leaving narrow regions between pores which will become the "nanowires" formed on the semiconductor material (silicon wafer). It is noted that Meerakker is silent about nanowires, however, the change relative to the etch depth and diameter of the pores is considered to be a change in size and shape, therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Van Den Meerakker to select any etch depth or pores diameter including the ones where pores diameters would intercept to form nanowires because it has been held that limitations relating to the size of the package were not sufficient to patentably distinguish over the prior art (see MPEP chapter 2144.04). One of ordinary skill in the art would have been motivated to scale the etch depth and pores diameters in order to obtain nanowires. Applicants did not show anything unexpected in scaling etch depth and pores diameters.

7. In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, motivation for

Art Unit: 1765

combining based on knowledge generally available to one of ordinary skill in the art has been presented.

***Conclusion***

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

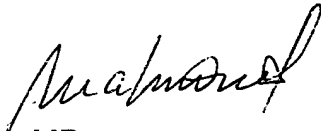
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mahmoud Dahimene whose telephone number is (571) 272-2410. The examiner can normally be reached on week days from 8:00 AM. to 5:00 PM..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1765

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
MD

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ART UNIT 1765